Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

2108 Biennial Review of Telecommunications Regulations	)	
Office of Engineering and Technology	)	ET Docket No. 18-370
Amending Parts 1 (Section 1.1307 and 1310), 2 (Subparts A, B, I, J and K), 5, 15, and 18	)	

Comments of Cisco Systems, Inc.

Introduction

This comment responds to the Commission's Public Notice of its 2018 Biennial Review and is directed to rules administered by the Office of Engineering and Technology.[1] Pursuant to the Commission's invitation to comment on rules that should be candidates for deletion or amendment because they are no longer in the public interest, Cisco Systems, Inc. (Cisco) is proposing to amend one Part 15 rule. Technology developments have made the existing rule partially obsolete and portions of the text need to be modernized.

[1] FCC Bureaus and Offices Seek Public Comment in 2018 Biennial Review of Telecommunications Regulations, Public Notice, CG Docket No. 18-375, EB Docket No. 18-379, IB Docket No. 18-377, ET Docket No. 18-370, PS Docket No. 18-376, WT Docket No. 18-374, WC Docket No. 18-378, Public Notice, DA 18-1260, released December 17, 2018. The original comment due date was scheduled for January 17, 2019. This comment is being filed on February 8, 2019 pursuant to instructions from the Public Notice, "Revisions to Filing and Other Deadlines Following Resumption of Normal Commission Operations," DA 19-26, released January 29, 2019.

Section 15.109[2] describes how manufacturers should present field strength measurement data to the Commission as part of the equipment certification process. Cisco's specific concern with Part 15.109 is limited to the field strength requirements for Class A devices, contained in Section 15.109(b). Class A devices are digital devices that are "marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home."[3]

The issue with the current rule is that technology has rendered the field strength measurement requirements outmoded. The field strength measurement requirement, as the rule was initially adopted, begins at the clock speed of the computer or microprocessor (i.e., the fundamental emission) and extends through a range of frequencies, initially to the tenth harmonic but subsequently extended to one gigahertz. The term "clock speed" refers to the operating speed of a computer or its microprocessor, defined as the rate at which it performs internal operations and expressed in cycles per second (i.e., megahertz). The current Part 15.109 Class A test requirements and limits were developed and adopted in the late 1980's.[4] At the time the rule was written, the "state of the art" for microprocessor clock speeds approached 25 MHz. Technology has long since surpassed that level, and for some devices such as optical systems the clock speed

[2] 47 CFR §15.109.

[3] 47 CFR §15.3.

[4] See 54 FR 17714, Apr. 25, 1989, as amended at 56 FR 373, Jan. 4, 1991; 58 FR 51249, Oct. 1, 1993; 66 FR 19098, Apr. 13, 2001; 67 FR 48993, July 29, 2002; 69 FR 2849, Jan. 21, 2004; 80 FR 33447, June 12, 2015.

operates at frequencies above 10 or 20 *GHz*, or even higher. That means today's technologies could have fundamental emissions of 10, 20, or 25 GHz by way of example.

In this filing, Cisco recommends that the Commission should at a minimum correct for the 4 dB penalty that high frequency (960 MHz and above) Class A devices pay relative to their low frequency Class A counterparts, as currently imposed by the limits chart in Section 15.109(b). That change by itself would greatly ease the measurement difficulties that manufacturers face in complying with the rules. The Commission could at the same time reformat the limits table to reflect a more commonly-utilized 3 meter measurement distance for high frequency Class A devices, while reiterating that measurements are allowed up to 10 meters. But more fundamentally, the Commission needs to future-proof this measurements rule. It should therefore initiate a review to abandon the flat or stepped limits plan now in use, and consider how to account for continuing advances in clock speeds.

Discussion

The difficulty for manufacturers today arises because the emission limit set by Section 15.109(b) is capped for any device operating above 1 GHz as a flat 300 microvolts/meter. That limit applies to any device that utilizes clock speed above 960 MHz, including advanced technologies where clock speeds are in the double-digit gigahertz range. Applying the rule to today's technologies is difficult to accomplish. Most significantly, at the upper frequency ranges the rule requires a measurement that is too close to the noise floor, given modern clock speeds. In fact, for some technologies, the noise floor can be above the emission limit. Consequently, a manufacturer seeking compliance for a Class A device has a difficult time measuring and

presenting data consistent with the rule. As will be discussed below, the Commission needs to consider adjusting the measurement emissions limits upwards to address technologies that utilize clock speeds well above 1 GHz.

If the rule is going to be re-examined, it should also be modernized to reflect how industry actually conducts measurements. At present, Section 15.109 calls out "up to 10 meters" as the maximum distance for measurements, and in the associated limits table, references limits measured at a 10 meter distance. As discussed above, due to modern clock speeds and fundamental emissions, at this distance the floor noise makes it difficult to detect the emissions especially when they are above 10 GHz. As a result, the industry has generally moved away from 10 meter testing to 3 meters. Note that even at 5 meters, measurement is difficult for advanced technologies today, but measuring closer to the device does help. Given how often a 3 meter distance is utilized in testing, Cisco recommends that the limits table provided in Section 15.109(b) be restated in terms of distances up to 3 meters, instead of providing the limits at 10 meters. However, Section 15.109(b) should specifically state that measurements up to a 10 meter distance are permitted, in order to allow for circumstances where the 10 meter measurement distance is more workable. Making these adjustments to the rule would provide clearer guidance to manufacturers when seeking approval of Class A unintentional radiators. At the same time, Cisco also recommends that the table be restated to utilize the commonly used "dB" measure of emissions instead of the "microvolts per meter" yardstick in the current rule.

The Commission also needs to take this opportunity to correct the penalty that Class A devices with fundamental emissions above 960 MHz pay relative to their low frequency Class A

counterparts. Per the charts below, at a 3 meter distance there is a 10 dB difference between Class A and Class B limits for equipment that is below 960 MHz. But at 960 MHz and above, Class A equipment is burdened with an emissions limit that is only 6 dB higher than Class B devices. In other words, Class A equipment with fundamental emissions above 960 MHz pays a 4 dB penalty relative to other Class A devices operating below 960 MHz. This penalty means that manufacturers must utilize additional expensive mitigation techniques to reduce unwanted emissions from the device. We see no justification for the additional 4 dB restriction above 960 MHz in a commercial or industrial environment.

Comparison of Current 15.109 Emissions Requirements for Class A and B Devices

Frequencies	**Current Class A at 10 meters**	**Current Class B at 3 meters**	**Difference between Class A and B limits at 3 meter distance**
30-88 MHz	90uV/m	100uV/m	10 dB
88-216 MHz	150uV/m	150uV/m	10 dB
216-960 MHz	210uV/m	200uV/m	10 dB
960 MHz and up	300uV/m	500uV/m	**6 dB**

Taking the above into account and correcting for the measurement distance (up to 3 meters), yields the following:

Class A Emission Requirements Correcting for the "Above 960 MHz" Penalty

Frequencies	**Current Limit at 10 m (uV/m)**	**Proposed Limit at 10 m (uV/m)**	**Proposed Limit at 10 m (dBuV/m)**	**Proposed Limit at 3 m (dBuV/m)**	**Proposed Limit at 3 m (uV/m)**
30-88 MHz	90	90	39.1	49.5	300
88-216 MHz	150	150	43.5	54	500
216-960 MHz	210	210	46.4	56.9	700
960 - 40 GHz	300	**500**	**54**	**64.4**	**1666.66**

However, the Commission should not stop at correcting the penalty that Class A devices above 960 MHz pay relative to their low frequency Class A counterparts and making format changes to the rule. Cisco recommends that the Commission undertake a fundamental review of the base limits for high frequency Class A devices. The existing limits are the same across frequency range from 1 GHz to 40 GHz, which implies that the interference potential is identical across the entire band. This premise is inaccurate and unnecessarily penalizes high frequency Class A devices. In lieu of this flat limit, Cisco would support an approach utilizing a sloping, frequency-dependent limit based upon the following:

- The change in path loss in free space over the range would mean at 40 GHz the limits should be more than 20 to 30 dB higher compared to those at 1 GHz. This aligns with the differentials at lower frequencies - in the 30 MHz – 1 GHz band, for example, there is an increase in the limit with respect to frequency.
- As the frequency increases, there is a significantly increased attenuation called by signal absorption in interior and exterior surfaces, including walls, concrete floors and other building structures.
- If there is a need to protect a particular service in a given band, then the limits for that band should be reduced based upon the characteristics of that service and not impact the entire band. In addition, these limits should only be imposed where the service is expected to be available. Given the long-standing 300 uV/m limit on Class A devices above 960 MHz, the Commission could use that level (or its 3-meter, dB equivalent) as a lower bound for unintentional emissions.
- As frequencies increase, unintentional emissions become much less of an interference risk in that the victim receiver would have to be aligned “line of sight” to the

emissions from the device. In addition, even in those rare cases where interference might occur, it is relatively simple to move the device or the victim into misalignment, and thereby avoid interference.

Conclusion

At a minimum, Cisco believes the Commission should at least correct for the 4 dB penalty that high frequency (960 MHz and above) Class A devices pay as a result of the existing limits chart in Section 15.109(b). That change by itself would greatly ease the measurement difficulties that manufacturers face in complying with Section 15.109(b). The Commission could at the same time reformat the limits to reflect the more commonly-utilized 3 meter distance, while specifying that measurements are allowed up to 10 meters, and convert the table to "dB" from "microvolts per meter". However, as stated above, the Commission needs to look at a fundamentally different approach than the flat, stepped limits now in use, and consider how to future-proof this Class A measurement rule to account for continuing advances in clock speeds.

Cisco thanks the Commission for the opportunity to address this outmoded rule via the Biennial Review process, and looks forward to working with the Office of Engineering and Technology and interested parties to address amendments to the rule.

Respectfully submitted,

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